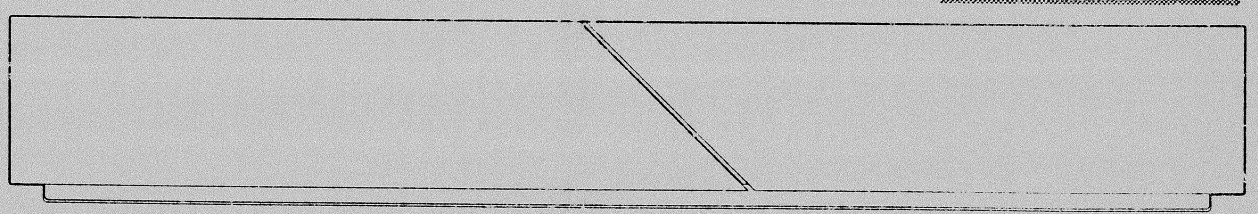
Service Manual

MSP 990 • MSP 991
MULTI SATELLITE POSITIONER

PACE

MSP
990/991



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IMPORTANT

- This service manual describes the MSP991 positioner. The main PCB inside the unit is at Revision B1. Earlier revisions of the PCB (A1 to A6) were used in the MSP990 positioner which is quite similar to the MSP991. Differences between Revision B1 and earlier versions are explained in brief on page 2 overleaf.

- The MSP990 and MSP991 positioners can generally be used with all types of Pace satellite receivers, but note that there are some restrictions on operating the positioner via a SCART lead from some early 9000 and 9200 series receivers (as described overleaf). Also, the second external decoder SCART connector on the MSP990 can only be used for decoders when a 9000 or 9200 series receiver is being used.

DIFFERENCES BETWEEN REVISION B1 BOARD AND EARLIER VERSIONS

The final 3 digits of the number printed below the word DISH POSITIONER on the PCB indicate the board revision: e.g. 101 = A1, 104 = A4, 201-B = B1 etc.

Changes for Revisions A1 to A6 of the PCB

Only small quantities of Revisions A1 and A2 were made. Capacitor C15 was added at Revision A3, a locating hole size was increased at Revision A4 and a fixing hole earthed to the case was added at Revision A5. A new type of 3-character, 7-segment LED was designed into Revision A6, but this revision was never built; instead the new LED was incorporated, with some other changes, into Revision B1 of the board.

Changes for Revision B1 of the PCB

Revision B1 of the board was designed for the new casing of the dish positioner, which has the front panel switches and LEDs in the same positions as on the Pace 700/800/900 series of satellite receivers.

Whereas in the A revisions the front panel push-button switches are in the fixed positions SW1, SW2, SW3 and SW4, on the B1 board they are designed to be in positions SW3, SW5, SW6 and SW7. This design requires the link J1 to be fitted and the links J2 and LK13 to be not fitted; SW3 is therefore the ⏻ (or STORE) button.

The B1 design allows, as an alternative, the switches to be fitted in positions SW1, SW2, SW3 and SW4, in which case links J2 and LK13 must be fitted and J1 must be not fitted, so that SW3 becomes the WEST button. This configuration would, however, mean that the switches would not be aligned with the correct front panel buttons for the new casing.

In the A revisions the LEDs are in fixed positions LED1, LED2, LED3 and LED4. In Revision B1 they are assembled in positions LED5, LED6, LED7 and LED8 and therefore align with the front panel legends. It would be possible, however, to mount the LEDs in their old positions, although they would no longer align with their legends.

Revision B1 of the board has a new layout to improve ground tracking, the positions of LK21, LK25 and LK40 have changed, and the resistor positions R39, R40, R41 and R42 have been added, although these resistors are not fitted.

The A revisions of the board also have a third SCART connector on the rear panel for a second external decoder. This connector is not fitted on Revision B1. For reference, the pin designations of this connector are given right. Note that as this additional external decoder SCART connector extends the facilities of Pace 9000 and 9200 series receivers, it can only be used with these models. A decoder should not be connected to this additional SCART connector if the MSP990 is connected to more recent models of receiver such as the 700/800/900 series and MRD920/950.

PIN	EXT. DECODER 2
1	N/C
2	N/C
3	N/C
4	Ground
5	Ground
6	N/C
7	N/C
8	Ext. Decoder Status In
9	Ground
10	N/C
11	N/C
12	N/C
13	Ground
14	N/C
15	N/C
16	N/C
17	Video Ground
18	Ground
19	Baseband Video Out
20	Video In
21	Ground (Casing)

Software Differences in Revision B1

The main software differences between the A revisions and B1 are that, for B1, 128 positions can be programmed (rather than 60) and these position numbers are not preceded by a letter P on the front panel display. The positioner now also interprets position number information sent to it from an appropriate satellite receiver (e.g. Pace 700/800/900 series) as well as the programme number information, as previously.

USING THE POSITIONER WITH EARLY 9000 AND 9200 SERIES RECEIVERS

When the MSP990 or MSP991 positioner is used with early versions of the 9000 series receivers (those with software version numbers 109525, 109526 and 109527) it should be remembered that these receivers transmit only 5-bit data down the SCART lead to the positioner. This results in programme number 33 being interpreted by the positioner as programme number 1, programme number 34 being interpreted as programme number 2 etc. This means that when programme numbers are programmed against position numbers (see also page 8), programmes 33 to 60 will be programmed to the same position numbers as programmes 1 to 28 respectively. (Note that the 9000 series receivers have max. 60 programmes.)

9000 series receivers with software version number 109529 and 9200 series receivers with version number 109532 use 6-bit data, therefore for the 9200 (max. 90 programmes) there is a similar "mirroring", but after programme number 64.

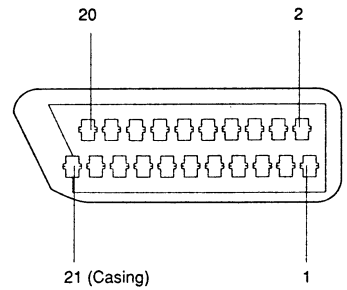
9200 series receivers with software version number 109533 and all subsequent receivers use 8-bit data transmission, therefore the positioner can interpret the programme number exactly.

OUTLINE SPECIFICATION

Output to actuator motor:	36 Vdc (nominal) floating isolated output (unfiltered, unregulated, rectified ac)
Maximum continuous load:	1 A rms
Intermittent load:	3 A
Overload protection:	3.15 A delay fuse
Relay switching:	15 A heavy-duty relay
Position feedback type:	pulse counting
Pulse count range:	000 to 999
Pulse repetition rate:	1 pulse every 2 secs (minimum) 100 pulses per sec (maximum)
Compatible actuators:	magnetic reed pulse generator type photo interrupter pulse generator type
Reed switch operating current:	5 mA (max.) (5 V source)
Photo interrupter supply:	+5 V dc / 50 mA max. (nominal)
IR remote control system:	pulse type serial data
Receiver control interface:	serial data input via pin 12 of interface SCART socket (Pace receivers only)
External decoder adapter:	SCART socket to allow connection of an external decoder to the receiver (Pace receivers only)
Power transformer:	high-efficiency, low-profile toroidal type
Dimensions:	H = 66 mm, W = 360 mm, D = 210 mm
Power requirement:	220/240 V ac 50 Hz standby mode 6 W typical full load (moving dish) 70 W max.
Operating temperature range:	0 - 40 °C
Safety standards:	class II insulation complies with HD195.56, BS 415, DEMKO, SEMKO and NEMKO

PIN DESIGNATIONS FOR SCART CONNECTORS

PIN	RECEIVER INTERFACE	PIN	EXT. DECODER
1	R Audio Out	1	R Audio Out
2	R Audio In	2	R Audio In
3	L Audio Out	3	L Audio Out
4	Audio Ground	4	Audio Ground
5	Blue Ground	5	Blue Ground
6	L Audio In	6	L Audio In
7	Blue Out	7	Blue In
8	Ext. Decoder Status Out	8	Ext. Decoder Status In
9	Green Ground	9	Green Ground
10	N/C	10	N/C
11	Green Out	11	Green In
12	Serial Data I/O Port	12	N/C
13	Red Ground	13	Red Ground
14	N/C	14	N/C
15	Red Out	15	Red In
16	RGB Status Out	16	RGB Status In
17	Video Ground	17	Video Ground
18	N/C	18	Ground
19	Video (Ext. Dec.) Out	19	Baseband Video Out
20	Baseband Video (Ext. Dec.) In	20	Video In
21	Ground (Casing)	21	Ground (Casing)



INSTALLATION

CAUTION: Incorrect installation could damage the actuator motor.

Connecting the Actuator

The 5-way rear panel socket is used to drive the actuator unit of the dish assembly.

For a **reed** type actuator, make the connections shown in Figure 1.

For an **optical** (photo interrupter) type actuator, make the connections shown in Figure 2.

Consult the instructions supplied with the actuator unit to determine where each of the coloured wires should be connected in the socket.

NOTE: The motor wires are generally thicker than the optical sensor wires. It is important that the optical sensor wires are screened and that the screen braid is connected to the ground terminal.

NOTE: If, after installation, the dish moves in the opposite direction to that expected when you press the WEST or EAST key, then the two motor wires will need to be reversed.

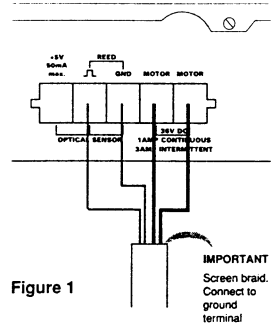


Figure 1

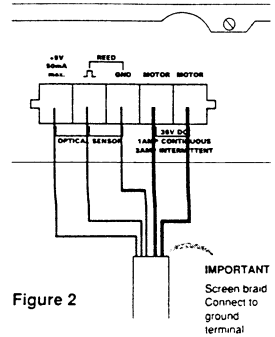


Figure 2

SCART Connection to a Pace Receiver

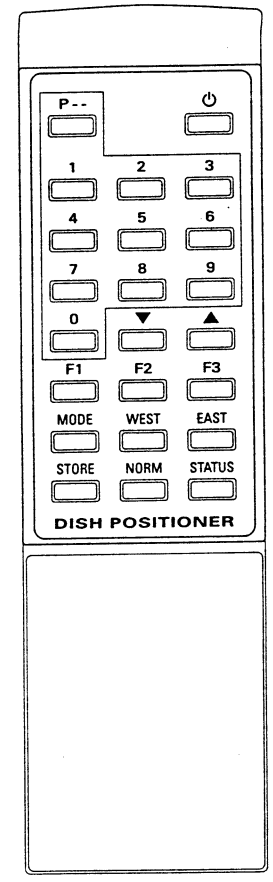
If you connect the positioner to a Pace receiver via a SCART lead, you can program satellite programme numbers against dish positions. If you do this, the positioner will automatically move the dish to the correct position when you select a satellite programme using the receiver's handset.

Connect the receiver to the positioner by connecting a full, 21-way SCART lead between the receiver's DECODER SCART connector and the positioner's RECEIVER INTERFACE SCART connector.

If an external decoder was connected to the receiver's DECODER SCART connector, you can now connect it to the positioner's EXT. DECODER SCART connector.

NOTE: If a budget SCART lead is used which does not have pin 12 wired, then the receiver will not be able to control the positioner.

HANDSET OVERVIEW



Standby Mode

⏻ key	brings the positioner out of standby mode
P-- key and/or 0-9 keys	brings the positioner out of standby mode

Normal Mode

⏻ key	puts the positioner into standby mode
P-- key and/or 0-9 keys	used to select a pre-programmed position number and thereby move the dish to this position
▲ and ▼ keys	used to step through the position numbers one at a time; ▲ increments the number ▼ decrements it
STATUS key	whilst held down, causes the 3-digit position of the current position number to be displayed
EAST or WEST key	puts the positioner into program mode; also used to stop the dish when it is moving between positions
MODE key then 1 key	puts the positioner into program mode
MODE key then 2 key	puts the positioner into set limits mode
MODE key then 9 key	puts the positioner into a mode where programme number rather than position number is displayed (this is only relevant for Pace 9000 series, 9200 series or MRD920 receivers, but see also page 2)
MODE key then 8 key	cancels the above "programme number display" mode

Program Mode

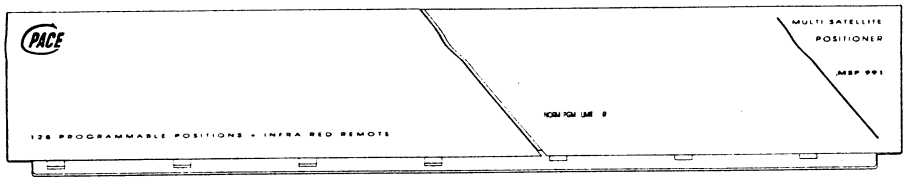
⏻ key	puts the positioner into standby mode
EAST or WEST key	moves the dish eastwards or westwards within the preset stop limits
P-- key and/or 0-9 keys	used to select the position number while programming or deleting positions
▲ and ▼ keys	used to change the position number while programming or deleting positions
STORE key	stores the position number against its 3-digit position; also, if a receiver is connected by a SCART lead, stores the current programme number against the position number
MODE key then 3 key	used to delete positions
NORM key	providing any changes have not been stored, used to return to normal mode without storing them
MODE key then 2 key	puts the positioner into set limits mode

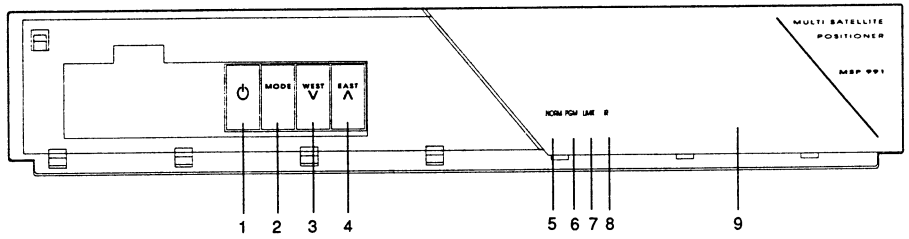
Set Limits Mode

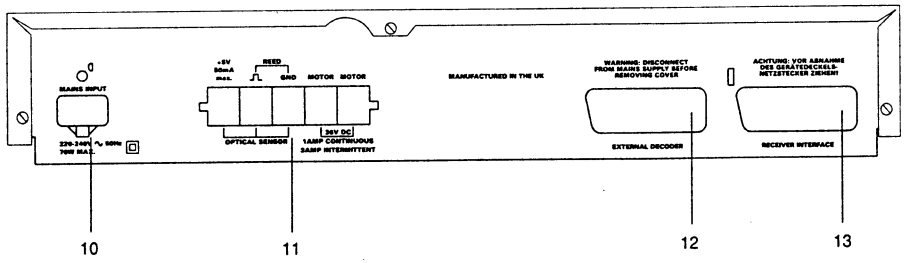
⏻ key	puts the positioner into standby mode
EAST or WEST key	moves the dish eastwards or westwards
STORE key	used to store the limits L1 and L2 as the east and west (or vice versa) stop limits of the dish panning range
MODE key	used, immediately after both limits have been reset, to save any previously programmed position numbers and to recalculate their 3-digit positions; otherwise used to return positioner to normal mode
NORM key	providing any changes have not been stored, used to return to normal mode without storing them

NOTE: The handset keys labelled F1, F2 and F3 are never used.

FRONT AND REAR PANEL DRAWINGS







1. Standby ON/OFF button
2. MODE button
3. ∨ WEST button
4. ∧ EAST button
5. NORMAL MODE LED
6. PROGRAM MODE LED
7. SET LIMITS MODE LED
8. IR receive LED
9. 3-character display

10. Mains connector
11. Dish motor cable connectors (actuator socket)
12. EXTERNAL DECODER SCART connector
13. RECEIVER INTERFACE SCART connector

NOTE: A label giving the model number and other product information is on the base of the unit.

FRONT PANEL OVERVIEW

*NOTE: In this overview if it states X **and** Y buttons, then it means that X and Y should be pressed simultaneously.*

Standby Mode

⏻ button	brings the positioner out of standby mode

Normal Mode

⏻ button	puts the positioner into standby mode
∧ EAST or ∨ WEST button	used to step through the position numbers one at a time; ∧ EAST increments the number, ∨ WEST decrements it
MODE button	whilst held down it causes the 3-digit position of the current position number to be displayed
MODE and ∨ WEST buttons	puts the positioner into program mode
∧ EAST and ∨ WEST buttons	puts the positioner into a mode where programme number rather than position number is displayed (this is only relevant for Pace 9000 series, 9200 series or MRD920 receivers, but see also page 2)

Program Mode

⏻ button	stores the position number against its 3-digit position; also, if a receiver is connected by a SCART lead, stores the current programme number against the position number

Before pressing the ⏻ button for the first time:

MODE button	before the dish has moved: used to enter set limits mode; after the dish has moved: used to return to normal mode
∧ EAST or ∨ WEST button	moves the dish eastwards or westwards within the preset stop limits

After pressing the ⏻ button for the first time:

∧ EAST or ∨ WEST button	used to change the position number
MODE button	used to abandon the storing operation by returning the positioner to normal mode

NOTE: You cannot delete position numbers using the front panel buttons; you must use the handset.

Set Limits Mode

∧ EAST or ∨ WEST button	moves the dish eastwards or westwards
⏻ button	used to store the limits L1 and L2 as the east and west (or vice versa) stop limits of the dish panning range
MODE button	used, immediately after both limits have been reset, to save any previously programmed position numbers and to recalculate their 3-digit positions; otherwise used to return positioner to normal mode

IMPORTANT OPERATIONS

OPERATING THE POSITIONER VIA THE RECEIVER

It is possible to program position numbers against satellite receiver programme numbers. If you do this and the positioner and receiver are connected together via a full, 21-way SCART lead, then when you select a programme at the receiver, the positioner will move the dish to the appropriate position for that programme.

The SCART lead connects the positioner's RECEIVER INTERFACE SCART connector to the receiver's DECODER SCART connector.

The method you need to use to program the position numbers against the programme number depends on the type of receiver, as described below.

Using the Positioner with Pace 700/800/900 Series Receivers

For the 700/800/900 series of receivers you program the position number against the programme number at the receiver, using the receiver handset and the on-screen menus - specifically the Tuning Menu. Consult the appropriate receiver user manual.

You can do this programming even if the receiver is disconnected from the positioner; as soon as you connect them together by a SCART lead, the dish will move to the correct position when you select a programme at the receiver. These receivers send information about the position number down the SCART lead to the positioner.

Using the Positioner with Pace 9000 Series, 9200 Series and MRD920 Receivers

For these receivers you program the position number against the programme number at the positioner while it is in program mode. These receivers send information about the programme number down the SCART lead to the positioner.

You need to know which satellite transmits each of the programmes you wish to program. At the positioner, program in position numbers for each of these satellites.

Connect the receiver and positioner together using a SCART lead.

Put the positioner into normal mode and key in the position number of the required satellite. When the dish is in the correct position, use the receiver handset to select the required programme.

Using the positioner handset, press the MODE key followed by the 1 key to put the positioner into program mode and then press the STORE key twice.

The PGM LED will extinguish and re-illuminate to show that you have now stored the position number against the programme number of the programme you can see on the TV.

If you wish to program further programmes from the same satellite, use the receiver handset to select the next programme and, on the positioner handset, press the STORE key twice.

Continue until you have programmed all the required programmes from that satellite. Note that you will, therefore, have programmed several different programme numbers against the same position number.

If you wish to program further programmes from other satellites you will need to press the NORM key to put the positioner into normal mode and use the positioner handset to move the dish to the next satellite position before repeating the above procedure.

It is possible to program position numbers against programme numbers at the same time that you program the position numbers against their 3-digit positions. You must however remember to connect the receiver and positioner together with a SCART lead before you do this.

If you use this method, you firstly search for the satellite position in program mode. Then, after pressing the STORE key for the first time, key in the position number and make sure you are viewing the required programme. When you press the STORE key for the second time the position number will be stored against the 3-digit position and against the programme number.

NOTE: For 9000 series, 9200 series and MRD920 receivers you should not program any satellite programmes against position 128. If you do this, the positioner interprets them as being "not set". You can use position 128 with later receivers such as the Pace 700/800/900 series.

NOTE: There are also some programme number restrictions for early versions of 9000 and 9200 series receivers - this is explained further on page 2.

Displaying Programme Numbers on the Positioner's Front Panel

If a Pace 9000 series, 9200 series or MRD920 receiver is being used with the positioner, you can set up the positioner to display the programme number rather than the position number when it is in normal mode.

To put the positioner into this "display programme number" mode from normal mode press the MODE key followed by the 9 key.

The front panel will display the number of the current programme. If you then use the receiver handset to select a different programme, this new programme number will be displayed. This is true even if the dish has moved in order to receive this programme. If you select a programme which is not programmed against a position number, the programme number is still displayed, followed by the words "not set".

If, while you are in this mode, you key in a different position number on the positioner handset, the dish will move to this new position, but the old programme number will still be displayed. This is because 9000 series, 9200 series and MRD920 receivers send information about the programme number down the SCART lead to the positioner. Even though the dish has moved, the receiver still has the original programme number selected, although you will no longer be able to see the programme on the TV screen.

To return to normal mode from "display programme number" mode, press the MODE key followed by the 8 key.

NOTE: As there are some programme number restrictions for early versions of 9000 and 9200 series receivers - as explained on page 2 - the true programme number may not always be displayed.

NOTE: It is not possible to display programme numbers on the positioner if it is connected to a 700/800/900 series receiver, as these receivers send information about the position number down the SCART lead to the positioner. This position number will be displayed in both normal mode and display mode.

CLEARING THE MEMORY

To reset the positioner to the state that it was in when it left the factory (i.e. no east or west limit set and no position numbers programmed in) press the P-- key then the STORE key then the STATUS key in quick succession. The display will flash and the positioner will reset itself.

NOTE: ALL POSITIONS, LIMITS ETC. THAT WERE SET WILL BE LOST.

RECOVERING POSITIONS AFTER A POWER FAILURE

Every time the dish comes to rest, the positioner stores information about the dish's position in its internal memory. Therefore if there is a power failure or the positioner is switched off when the dish is stationary, all of the stored positions will still be programmed in when power is restored.

If, however, there is a power failure while the dish is actually moving, these stored positions will be lost unless you carry out the recovery procedure outlined below. For this procedure to work, position 1 must have been programmed and you must know which satellite was assigned to position 1.

When power is restored after the power failure, all three front panel LEDs will illuminate and the word "set" will flash on the front panel display. The positioner is now in a "recovery" mode.

Use the EAST or WEST handset key (or the ∧ EAST or ∨ WEST front panel button) to move the dish until you see on the TV screen a programme from the satellite which was assigned to position 1.

Press the STORE key on the handset or the ⏻ button on the front panel.

The positioner will now function as it did before the power failure and all of the previously programmed positions will have been restored.

GAINING ACCESS TO THE UNIT

REMEMBER - SAFETY FIRST

WARNING: Always disconnect the unit from the mains supply before dismantling it.

WARNING: The incorrect substitution of electrolytic capacitors may result in an explosion hazard.

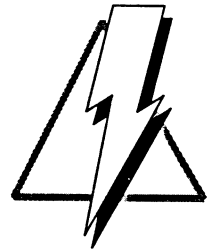
CAUTION: Work on an earth mat and wear a wrist strap and earth lead to prevent electrostatic damage to the components. Once the circuit board is removed from the casing it is fairly flexible, so handle it carefully to avoid damaging the components.

CAUTION: You must replace all the PCB fixings, screws etc. when the unit is re-assembled, otherwise there could be hazards due to reduced clearances.

CAUTION: Before you apply mains power to the unit, always ensure that the voltage rating stated on the rear panel of the unit matches the mains voltage supply in the country of installation.

CAUTION: Do not spray any chemicals on or near the unit.

CAUTION: Replacements for faulty components must be of the correct value and rating and must be assembled by a competent engineer, otherwise safety approvals could be invalidated.



Removing the Cover

Remove the 5 taptite screws (A). Three are at the rear of the unit (Figure 1) and one is in each side (Figure 2).

Hold both sides of the cover and slide it towards the rear of the unit to remove it.

Removing the Front Panel

Once the top cover has been removed, remove the front panel by gently prising the two lugs (X) outwards, as shown in Figure 3.

Removing the PCB

Refer to Figure 3.

Disconnect the two connectors which connect the toroidal mains transformer (C) to the PCB. Unscrew and remove the transformer from the unit (see Figure 4).

Remove the two actuator socket screws (B).

Remove the mains socket screw (D).

Remove ground connection taptite screw (F).

Remove the 3 push rivet fixings (E).

Whilst lifting the front edge of the main PCB, use pliers to crimp together the stand-off prong (H) and thereby free the PCB.

Gently slide the PCB away from the rear panel to remove it from the casing.

Re-assembling the Unit

Reverse the above procedures to re-assemble the unit.

CAUTION: The rubber discs must be present on both sides of the transformer, otherwise it could be damaged.

CAUTION: Do not overtighten the screw which holds the transformer in position, as the wires may get squashed, thereby damaging the transformer.

Figure 1

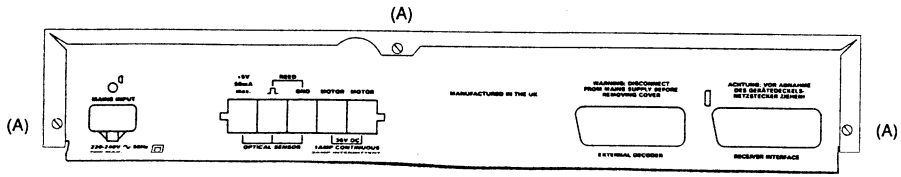


Figure 2

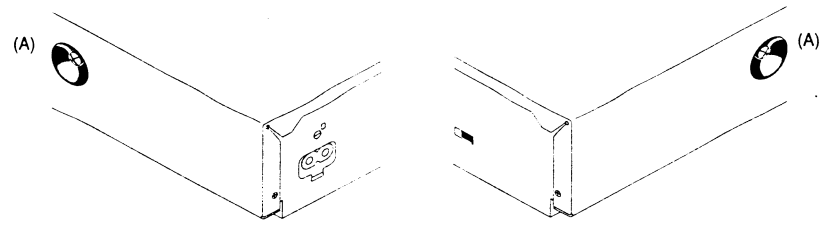


Figure 3 - Top View

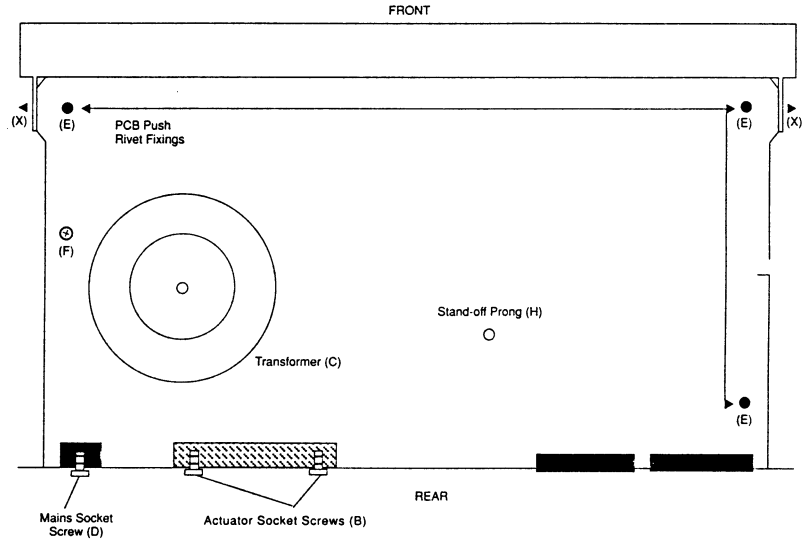
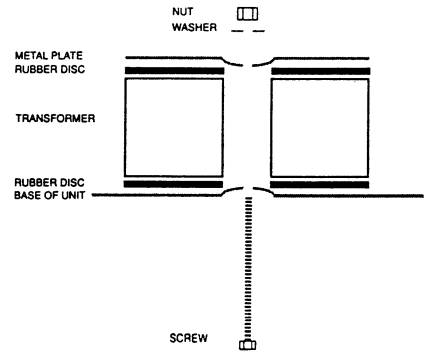
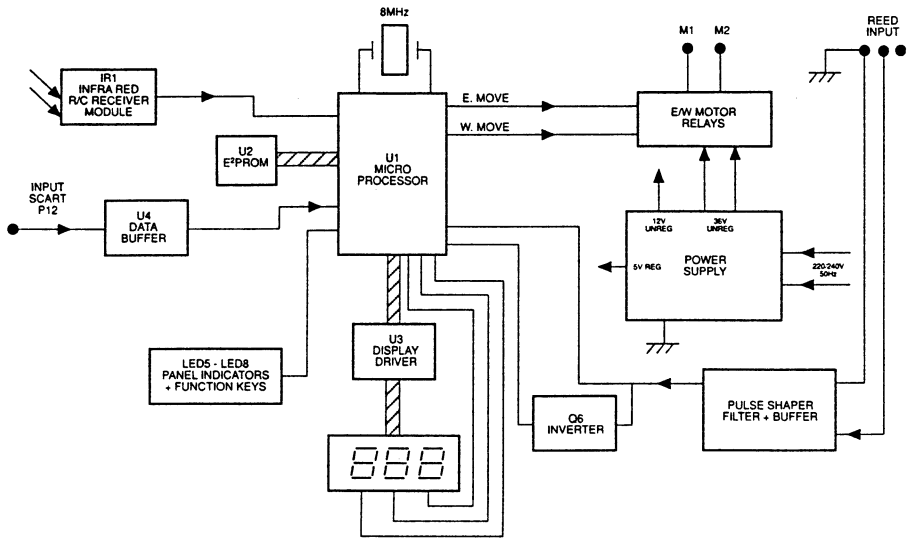


Figure 4



BLOCK DIAGRAM



CIRCUIT DESCRIPTION

Microprocessor

The dish positioner system is centered around the Z8 microprocessor U1. This contains an on-chip clock reference oscillator for which an external 8 MHz crystal is used. The system control software is stored within ROM which is an integral part.of U1. The microprocessor is active at all times, including during standby mode. During the installation procedure, all the user-definable variables (east/west limit positions, dish positions etc.) are stored in the non-volatile E²PROM U2. The microprocessor U1 communicates directly with E²PROM U2 via a serial data bus.

Control Inputs

The user control input to U1 is via the front panel switch keys SW3, SW5, SW6 and SW7, or via the infra-red (IR) remote-control handset. The serial coded IR signal is received by the IR receiver module IR1. The output from IR1, in the form of TTL serial data, is coupled directly to the IR input port of U1. The dish positioner may also receive serial data via a SCART cable from certain compatible satellite receivers. The SCART serial data link will send receiver programme or satellite number information to U1 via inverting buffer U4E, thereby allowing automatic selection of the dish position when the programme on the satellite receiver is changed.

NOTE: If you are tracing the serial data from the satellite receiver via the interface SCART, the data stream is fast and the individual pulses are narrow. Furthermore, the data word is sent by the receiver only once during each programme change. You must therefore use a digital storage oscilloscope in order to see the data stream.

LED Indicators and Display

The individual LED indicators (LED5-LED8) are driven by inverting buffers U4A, U4B, U4C and U4F under the control of four dedicated output ports on U1. The 3-character LED display is controlled by software-multiplexed output ports on U1. The display is a common anode type, with the digit anodes strobe-switched by transistors Q1-Q3. The segment cathodes are driven by U3 which is an 8-way non-inverting buffer. The decimal point cathode is not used in this product.

Actuator Control

The dish movement direction is set by the polarity of the 36 Vdc power applied to the actuator motor output terminals (SK4,4-SK4,5). The output terminals are connected via the contacts of two relays RL1 and RL2, which control the dish movement east or west respectively. The relays are controlled by transistor switches Q4-Q5, which are in turn driven by two output ports on U1. In order to protect the relay contacts from excessive spark damage, the motor back-emf surges are absorbed by the network R35 and C7.

Actuator Feedback

Dish movement information is fed from the actuator to the dish positioner by feedback pulses. These pulses are usually produced by a rotating magnet/reed switch type of pulse generator in the actuator unit. However, some actuators use a photo-interrupter type of pulse generator. The pulses returned from both types are similar, but the photo-interrupter type requires a power source to energise the pulse generator. An extra terminal (SK4,1) carrying 5 Vdc is provided for this purpose.

The current available at this terminal is limited by a resistor R38 to provide short circuit protection. No connection should be made to this terminal when using reed type actuators. The pulses are returned from the actuator via SK4,2 (pulse in) and SK4,3 (ground). They pass through low-pass filter R31 and C6 to inverting buffer U4D then into U1 via a direct path and an inverted path (Q6). Diodes D4 and D3 are provided to protect against induced transient damage. The resistor R33 provides a 5 mA current source for the reed switch.

The current dish position at any time is stored in a register within U1 as a numerical value in the range 0-999. Depending on the direction of movement, this value is incremented or decremented by 1 count for each pulse received from the actuator.

Power Supply

The positioner is designed to operate from a 220 V or 240 V ac supply. A toroidal power transformer is used which has two secondary windings. A thermal overload fuse is built into the primary winding to protect against an extreme overload temperature rise. If this fuse becomes open circuit, the transformer must be replaced and the cause of the overload condition eliminated. The secondary windings are protected against short circuit faults by fuses FS2 and FS3.

The output from the 36 V winding is rectified by bridge rectifier BR1 to provide unfiltered, unregulated dc to drive the actuator motor. The motor output is a nominal 36 Vdc, but actual voltage will vary under differing load conditions.

The output from the 12 V winding is rectified by D6, D7, D8 and D9 and filtered by C11, thus giving an unregulated 12 Vdc supply for the relay coils. The regulator REG1 provides a 5 Vdc rail for all other circuits.

SCART Sockets

Two 21 way SCART connectors are provided on the rear panel. The RECEIVER INTERFACE connector SK1 can be connected via a SCART lead (which must have all 21 pins connected) to the DECODER SCART socket on certain compatible satellite receivers. In addition to controlling the receiver directly, as described earlier, the dish positioner allows an external decoder to be connected to the EXT DE-CODER socket. Without this SCART socket, connection of a decoder would not be possible because the receiver's DECODER SCART socket is occupied by the dish positioner's SCART lead.

CIRCUIT DIAGRAM GRID REFERENCES

CAPACITORS	
C1	C7
C2	D6
C3	D5
C4	D4
C5	C6
C6	C4
C7	B2
C9	C8
C10	D5
C11	A4
C12	A5
C13	D5
C14*	A4
C15	C6

DIODES	
D1	C8
D2	C7
D3	C3
D4	C3
D5	C6
D6	A4
D7	A4
D8	A4
D9	A4

LEDS	
LED1*/8	C7
LED2*/7	C8
LED3*/6	C8
LED4*/5	C8
LEDA	D2

TRANSISTORS	
Q1	D3
Q2	D3
Q3	D2
Q4	B8
Q5	B7
Q6	C5

RESISTORS	
R1	B8
R2	D7
R3	D7
R4	D7
R5	D7
R6	D6
R7	C8
R8	C8
R9	C8
R10	C7
R11	C5
R12	C4
R13	B4
R15	B7
R16	B7
R17	D4
R18	D4
R19	D3
R20	D3
R21	D2
R22	D2
R23	D4
R24	D4
R25	D4
R26	C4
R27	C4
R28	C4
R29	C4
R30*	C4
R31	C3
R32	C2
R33	C2
R35	B2
R36	B8
R37	B7
R38	C2
R39*	C3
R40*	C3
R41*	C4
R42*	C4

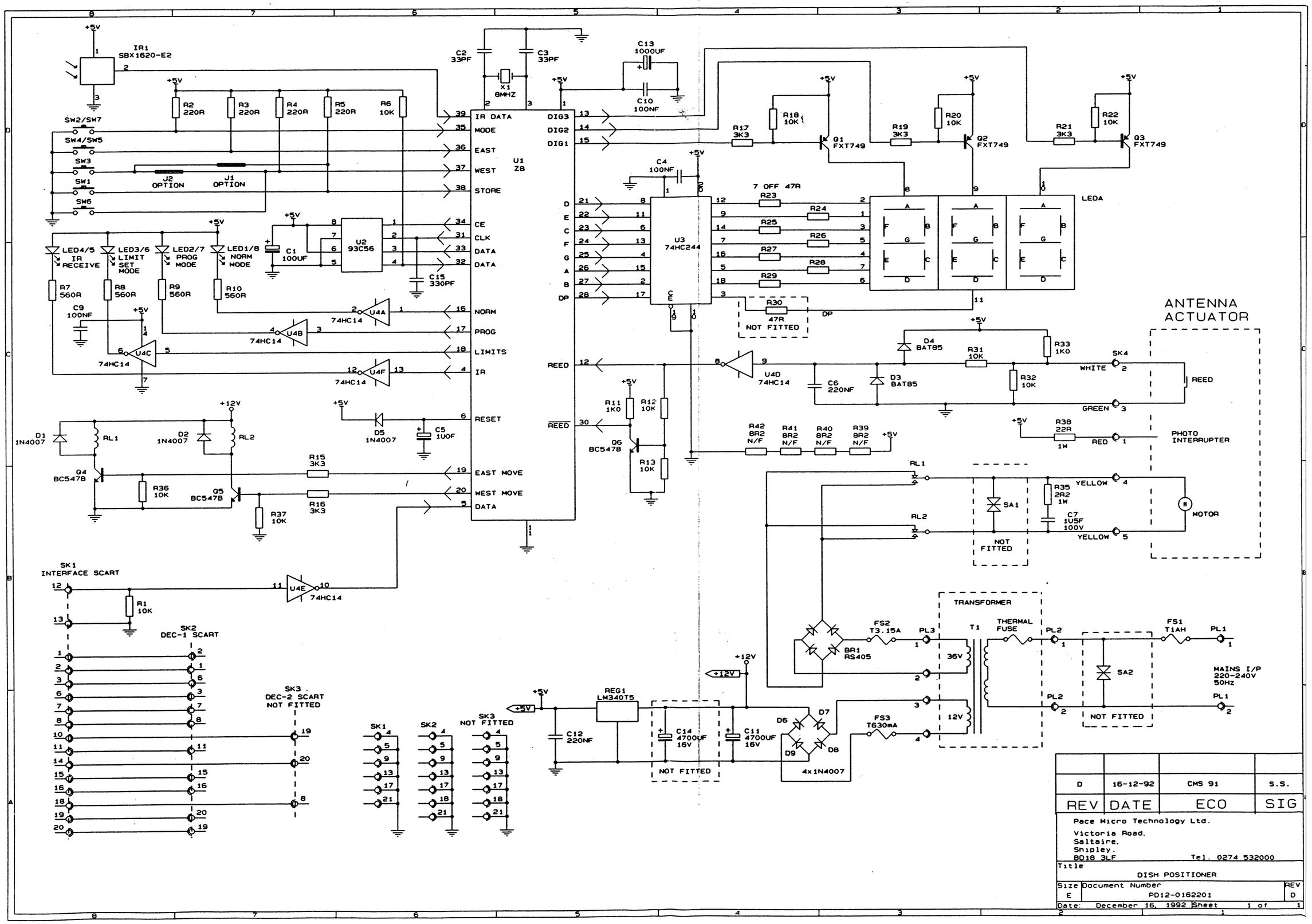
CONNECTORS	
PL1	B1
PL2	B2
PL3	B3
SK1	B8
SK2	B7
SK3*	A7
SK4	C2

ICS	
U1	D5
U2	C6
U3	C4
U4A	C6
U4B	C7
U4C	C8
U4D	C4
U4E	B7
U4F	C6

MISC. COMPONENTS	
BR1	B3
FS1	B1
FS2	B3
FS3	A3
IR1	D8
J1	D7
J2*	D8
REG1	A5
RL1	B3/C8
RL2	B3/C7
SA1*	B2
SA2*	B2
SW1*	D8
SW2*/7	D8
SW3	D8
SW4*/5	D8
SW6	D8
T1	B3
X1	D5

* not fitted

CIRCUIT DIAGRAM



REV	DATE	ECO	SIG
D	16-12-92	CMS 91	S.S.

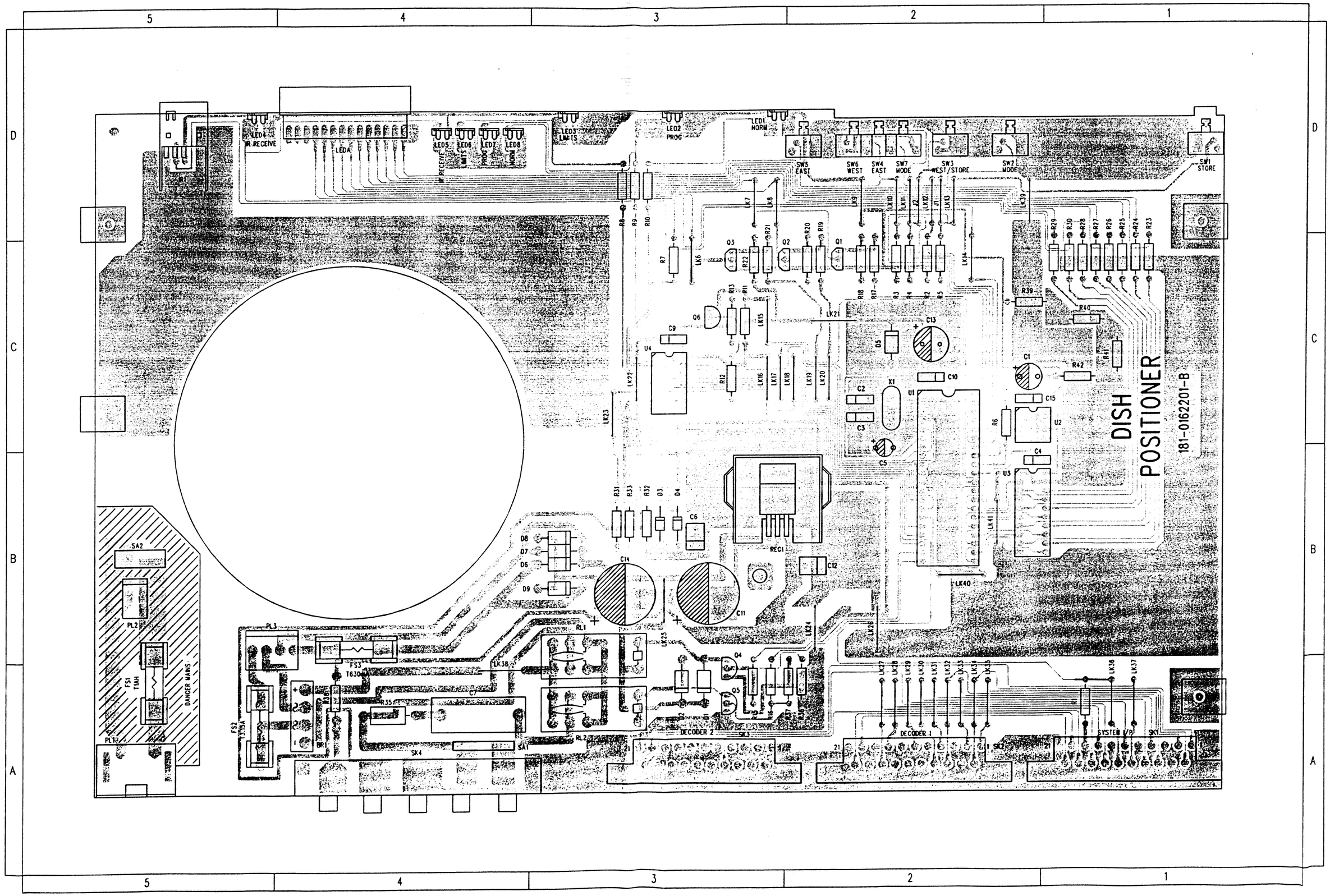
Pace Micro Technology Ltd.
Victoria Road,
Saltaire,
Shipley.
BD18 3LF Tel. 0274 532000

Title: DISH POSITIONER

Size	Document Number	REV
E	PD12-0162201	D

Date: December 16, 1992 Sheet 1 of 1

PRINTED CIRCUIT BOARD - COMPONENT SIDE



ERROR MESSAGES

The positioner will only display error messages during read/write operations to the E²PROM U2.

MESSAGE	WHEN DISPLAYED	REASON
Er1	As dish comes to rest after a move	Current position read/write has failed.
Er1	As second limit is set on positioner	West limit read/write has failed.
Er1	As a position is programmed	Selected position read/write has failed.
Er1	Before the dish is moved	Power fail flag read/write has failed.
Er1	Only when assigning programmes to positions when used in conjunction with a receiver	Programme programming read/write has failed.
E2	At any time	U2 has failed to respond to a read operation within the required time
E3	At any time	U2 has failed to respond to a write operation within the required time

NOTE: E2 and E3 can occur under the same conditions as those for Er1, above, in which case they will be displayed instead of Er1.

The only way to recover from E2 and E3 errors is to power off the positioner. If they occur regularly, then U2 is probably faulty.

It may be possible to recover from Er1 errors by clearing the memory by pressing the P--, STORE and STATUS keys in that order.

NOTE: All position settings etc. will be lost when you clear the memory.

PRINTED CIRCUIT BOARD GRID REFERENCES

CAPACITORS	
C1	C2
C2	C2
C3	C2
C4	B2
C5	C2
C6	B3
C7	A4
C9	C3
C10	C2
C11	B3
C12	B2
C13	C2
C14*	B3
C15	C2

DIODES	
D1	A3
D2	A3
D3	B3
D4	B3
D5	C2
D6	B3
D7	B3
D8	B3
D9	B3

LEDS	
LED1*	D3
LED2*	D3
LED3*	D3
LED4*	D5
LED5	D4
LED6	D4
LED7	D4
LED8	D4
LEDA	D4

WIRE LINKS	
LK6	C3
LK7	D3
LK8	D3
LK9	D2
LK10	D2
LK11	D2
LK12	D2
LK13*	D2
LK14	C2
LK15	C3
LK16	C3
LK17	C3
LK18	C2
LK19	C2
LK20	C2
LK21	C2
LK22	C3
LK23	C3
LK24	B2
LK25	B3
LK26	B2
LK27	A2
LK28	A2
LK29	A2
LK30	A2
LK31	A2
LK32	A2
LK33	A2
LK34	A2
LK35	A2
LK36	A1
LK37	A1
LK38	A4
LK39	D2
LK40	B2
LK41	B2
J1	D2
J2*	D2

TRANSISTORS	
Q1	C2
Q2	C2
Q3	C3
Q4	A3
Q5	A3
Q6	C3

RESISTORS	
R1	A1
R2	C2
R3	C2
R4	C2
R5	C2
R6	C2
R7	C3
R8	D3
R9	D3
R10	D3
R11	C3
R12	C3
R13	C3
R15	A3
R16	A3
R17	C2
R18	C2
R19	C2
R20	C2
R21	C3
R22	C3
R23	C1
R24	C1
R25	C1
R26	C1
R27	C1
R28	C1
R29	C1
R30*	C1
R31	B3
R32	B3
R33	B3
R35	A4
R36	A2
R37	A2
R38	A4
R39*	C2
R40*	C1
R41*	C1
R42*	C1

CONNECTORS	
PL1	A5
PL2	B5
PL3	B4
SK1	A1
SK2	A2
SK3*	A3
SK4	A4

ICS	
U1	B2
U2	C2
U3	B2
U4	C3

MISC. COMPONENTS	
BR1	A4
FS1	A5
FS2	A5
FS3	B4
IR1	D5
REG1	B3
RL1	B3
RL2	A3
SA1*	A4
SA2*	B5
SW1*	D1
SW2*	D2
SW3	D2
SW4*	D2
SW5	D2
SW6	D2
SW7	D2
T1	C4
X1	C2

* not fitted

FAULT FINDING

SYMPTOMS	POSSIBLE CAUSE	ACTION
Unit dead - all LED displays off	Fuse FS1 O/C; Fuse FS3 O/C	Replace fuse(s), investigate and clear condition which caused blown fuse(s).
	Regulator REG1 O/C	Replace regulator.
	T1 thermal primary fuse O/C	Replace T1 - investigate for severe excess actuator load current repair/ replace actuator.
Display LEDs active relays click when E/W buttons pressed, but there is no motor drive	Fuse FS2 O/C	Replace fuse, check for short circuit on external circuit to motor. Check for short circuit in bridge rectifier BR1.
	Motor wires badly connected into rear panel connectors e.g. clamped onto wire insulation	Reconnect motor wires, stripping wire insulation if necessary.
When E/W button is pressed, actuator moves for 2 secs but display does not count, then "Err" displayed	No feedback pulses	Check reed wires for bad or O/C connection. Check for defective reed switch in actuator. Trace for presence of pulses via U4D and Q6 into U1 pins 12 and 30.
When E/W button is pressed, there is no relay click, no actuator movement and "End" is displayed immediately	Limits L1 and L2 have been set to same position	Enter set limits mode and reset positions for L1 and L2.
Positioner will not respond to compatible receiver	SCART lead may not be fully wired	Check the lead and ensure that all pins are connected, particularly pin 12 to pin 12 at both ends (budget leads often do not have this connection). Replace the lead with a fully wired 21-way SCART lead.

SPARES - ELECTRICAL PARTS LIST

Capacitors

C1	100UF 16V 5MMRADIAL ELECT' CAPTR	155-1071751
C2	33PF 16V 5MMCERAMIC CAPTR	150-3301951
C3	33PF 16V 5MMCERAMIC CAPTR	150-3301951
C4	100NF 50V 5MM M/LAYER CER.CAP TR	157-1045751
C5	1UF16V 5MMRADIAL ELECT' CAPTR	155-1051751
C6	220NF 50V 5MM M/LAYER CER.CAP TR	157-2245751
C7	1U5100V 22.5MM BOX POLYESTER CAP	152-1527690
C9	100NF 50V 5MM M/LAYER CER.CAP TR	157-1045751
C10	100NF 50V 5MM M/LAYER CER.CAP TR	157-1045751
C11	4700UF 16V 7.5MM RADIAL ELECT' CAP	155-4781770
C12	220NF 50V 5MM M/LAYER CER.CAP TR	157-2245751
C13	1000UF 16V 5MM RAD ELEC' CAP (10X16)	155-1081750
C15	330PF 50V 2.5MM CERAMIC CAP	150-3315920

Diodes

D1	DIODE-1N4007TR	120-0400701
D2	DIODE-1N4007TR	120-0400701
D3	SIGNAL DIODE-BAT85 TR	120-0008501
D4	SIGNAL DIODE-BAT85 TR	120-0008501
D5	DIODE-1N4007TR	120-0400701
D6	DIODE-1N4007TR	120-0400701
D7	DIODE-1N4007TR	120-0400701
D8	DIODE-1N4007TR	120-0400701
D9	DIODE-1N4007TR	120-0400701

LEDs

LED5	LED-GREEN 5MM H/EFF ROUND	200-0110501
LED6	LED-GREEN 5MM H/EFF ROUND	200-0110501
LED7	LED-GREEN 5MM H/EFF ROUND	200-0110501
LED8	LED-GREEN 5MM H/EFF ROUND	200-0110501
LED A	3-UNIT 7-SEG DISPLAY GREEN	200-7030102

Transistors

Q1	TRANSISTOR-FXT749 (ZETEX)TR	110-0074911
Q2	TRANSISTOR-FXT749 (ZETEX)TR	110-0074911
Q3	TRANSISTOR-FXT749 (ZETEX)TR	110-0074911
Q4	TRANSISTOR-BC547B NPN TO-92 PACKAGE TR	110-1054701
Q5	TRANSISTOR-BC547B NPN TO-92 PACKAGE TR	110-1054701
Q6	TRANSISTOR-BC547B NPN TO-92 PACKAGE TR	110-1054701

Connectors

PL1	"A" LEONHARDY 07-78.2300 MAINS INPUT SKT	875-0778231
PL2	HEADER-2 WAY 3150-8-102-01	161-1000203
PL3	HEADER-4 WAY 3150-8-104-01	161-1000403
SK1	SCART SOCKET-MKF6341 (NO LUGS)	163-2102112
SK2	SCART SOCKET-MKF6341 (NO LUGS)	163-2102112
SK4	CHAP/IRTE 5 POLE PUSH TERMINAL "CUSTOM"	163-5000501

Resistors

R1	10K0.25W 5% CARBON FILM RES TR	140-1032501
R2	220R 0.25W 5% CARBON FILM RES TR	140-2212501
R3	220R 0.25W 5% CARBON FILM RES TR	140-2212501
R4	220R 0.25W 5% CARBON FILM RES TR	140-2212501
R5	220R 0.25W 5% CARBON FILM RES TR	140-2212501
R6	10K0.25W 5% CARBON FILM RES TR	140-1032501
R7	560R 0.25W 5% CARBON FILM RES TR	140-5612501
R8	560R 0.25W 5% CARBON FILM RES TR	140-5612501
R9	560R 0.25W 5% CARBON FILM RES TR	140-5612501
R10	560R 0.25W 5% CARBON FILM RES TR	140-5612501
R11	1K0.25W 5% CARBON FILM RES TR	140-1022501
R12	10K0.25W 5% CARBON FILM RES TR	140-1032501
R13	10K0.25W 5% CARBON FILM RES TR	140-1032501
R15	3K30.25W 5% CARBON FILM RES TR	140-3322501
R16	3K30.25W 5% CARBON FILM RES TR	140-3322501
R17	3K30.25W 5% CARBON FILM RES TR	140-3322501
R18	10K0.25W 5% CARBON FILM RES TR	140-1032501
R19	3K30.25W 5% CARBON FILM RES TR	140-3322501
R20	10K0.25W 5% CARBON FILM RES TR	140-1032501
R21	3K30.25W 5% CARBON FILM RES TR	140-3322501
R22	10K0.25W 5% CARBON FILM RES TR	140-1032501
R23	47R0.25W 5% CARBON FILM RES TR	140-4702501
R24	47R0.25W 5% CARBON FILM RES TR	140-4702501
R25	47R0.25W 5% CARBON FILM RES TR	140-4702501
R26	47R0.25W 5% CARBON FILM RES TR	140-4702501
R27	47R0.25W 5% CARBON FILM RES TR	140-4702501
R28	47R0.25W 5% CARBON FILM RES TR	140-4702501
R29	47R0.25W 5% CARBON FILM RES TR	140-4702501
R31	10K0.25W 5% CARBON FILM RES TR	140-1032501
R32	10K0.25W 5% CARBON FILM RES TR	140-1032501
R33	1K0.25W 5% CARBON FILM RES TR	140-1022501
R35	2R21W5% CARBON FILM RES TR	140-0226501
R36	10K0.25W 5% CARBON FILM RES TR	140-1032501
R37	10K0.25W 5% CARBON FILM RES TR	140-1032501
R38	22R1W5% CARBON FILM RES TR	140-2206501

ICs

U1	8621 PROG PROCESSOR V1.0 FOR MSP991	809-8621703
U2	93C56 2K EE	104-0935601
U3	74HC244 OCTAL TRI-STATE BUFFER	102-1024400
U4	74HC14	102-1001400

Misc. Components

BR1	BRIDGE RECTIFIER-RS405 600V	115-0040500
FS1	"A"FUSE-T1A 20MM X 5MM CERAMIC TIMELAG	201-2531000
FS2	"A" FUSE-3.15A 5 X 20MM ANTI-SURGE	201-2513150
FS3	"A"FUSE-630MA 20MM X 5MM S504 ANTI-SURGE	201-2510630
IR1	SONY INFRA-RED REC MODULE (SBX 1620-E2)	215-1620002
J1	TINNED COPPER WIRE LINKS 0.61MM DIA.(TRS	999-1099901
All LKs	TINNED COPPER WIRE LINKS 0.61MM DIA.(TRS	999-1099901
REG1	V/REGULATOR-LM340T5 +5V 1.5A TO-220	105-0034000
RL1	RELAY-VSB12-STB 12V TAKAMISAWA	136-0001201
RL2	RELAY-VSB12-STB 12V TAKAMISAWA	136-0001201
SW3	SWITCH-B3F3152 PCB SUBMIN 150GM (YELL.)	204-0315211
SW5	SWITCH-B3F3152 PCB SUBMIN 150GM (YELL.)	204-0315211
SW6	SWITCH-B3F3152 PCB SUBMIN 150GM (YELL.)	204-0315211
SW7	SWITCH-B3F3152 PCB SUBMIN 150GM (YELL.)	204-0315211
T1	"A"TRANSFORMER-TOROIDAL 3866 WITH FUSE	238-0386601
X1	CRYSTAL-8MHZ HC49U 20/50/10/ 30PF PAR	170-0080000